Attorney Docket No. P11258

IN THE CLAIMS

This listing of claims replaces all previous versions and listings of claims in the application.

Listing of Claims

1-14. (Canceled)

15. (Previously Presented) A method of controlling a data unit oriented communication between a sender and a receiver operating in accordance with a predetermined communication protocol, said method comprising the steps of:

dividing, by the sender, an amount of data to be sent into a plurality of data units having a structure determined by the protocol;

transmitting initial data units from the sender to the receiver; i

acknowledging, by the receiver, correct receipt of the initial data units by returning acknowledgment data units to the sender; ii

detecting a failure of the receiver to receive at least one data unit by monitoring a time out period by the sender after the at least one data unit is sent, and if no acknowledgment data unit associated with the data unit is received before the time out period expires, triggering a time out mechanism that indicates the failure; iv

retransmitting, by the sender, the at least one data unit that the receiver failed to receive; iii

receiving at the sender, an acknowledgment data unit indicating that at least one of the data units was correctly received by the receiver; see ii

determining whether the received acknowledgment data unit indicates that the at least one correctly received data unit was correctly received as a result of the transmitting step or as a result of the retransmitting step, said determining step including the steps of:

determining by the sender, a shortest round trip time associated with the correct receipt of an initial data unit;

measuring by the sender, a time period between the retransmission of a given data unit and the receipt of a first acknowledgment data unit associated with the given data unit;

comparing the shortest round trip time to the time period between the retransmission of the given data unit and the receipt of the first acknowledgment data unit; and

determining that the at least one data unit was correctly received as a result of the transmitting step if the time period between the retransmission of the given data unit and the receipt of the first acknowledgment data unit is shorter than a predetermined fraction of the shortest round trip;

subsequently transmitting, by the sender, subsequent data units, said subsequent data units being transmitted in accordance with a flow control procedure conducted on the basis of at least one adaptive parameter, said subsequently transmitting step including:

performing an excessive delay response procedure upon determining that the received acknowledgment data unit indicates that the at least one data unit was correctly received as a result of the transmitting step; and

performing a data unit loss response procedure upon determining that the received acknowledgment data unit indicates that the at least one data unit was correctly received as a result of the retransmitting step.

16-34. (Canceled)

35. (Currently Amended) A device for controlling a data unit oriented communication between a sender and a receiver operating in accordance with a predetermined communication protocol, said device comprising:

means in the sender for dividing an amount of data to be sent into a plurality of data units having a structure determined by the protocol;

a data unit transmitter that transmits the data units from the sender to the receiver;

means in the receiver for acknowledging correct receipt of the transmitted data units by returning acknowledgment data units to the sender;

a data loss detection mechanism that detects [[a]] an apparent failure of the receiver to receive ~~at least one~~ an initial data unit;

flow-control adapting means, responsive to the data loss detection mechanism, for adapting flow control parameters to transmit subsequent data units in accordance with a data unit loss response procedure, and for causing the data unit transmitter to retransmit the data unit that the receiver apparently failed to receive;

~~retransmission means in the sender that retransmits the at least one data unit that the receiver failed to receive;~~

receiving means in the sender for subsequently receiving an acknowledgment data unit indicating that the ~~at least one~~ data unit that the receiver apparently failed to receive was correctly received by the receiver;

determining means for determining ~~whether~~ from the received acknowledgment data unit, ~~indicates that the at least one data unit was correctly received as a result of the transmitting step or as a result of the retransmitting step~~ whether the correctly received data unit was the initial data unit or the retransmitted data unit;

~~means within the transmission means for subsequently transmitting subsequent data units utilizing a flow control procedure conducted on the basis of at least one adaptive parameter, said subsequent transmission means including:~~

~~an excessive delay response mechanism that performs an excessive delay response procedure in response to the determining means determining that the received acknowledgment data unit indicates that the at least one data unit was correctly received as a result of the transmitting step; and~~

~~a data unit loss response mechanism that performs a data unit loss response procedure in response to the determining means determining that the received acknowledgment data unit indicates that the at least one data unit was correctly received as a result of the retransmitting step~~

a data unit loss response mechanism for continuing to transmit subsequent data units in accordance with the data unit loss response procedure, in response to a determination that the correctly received data unit was the retransmitted data unit; and

an excessive delay response mechanism for causing the flow-control adapting means to adapt the flow control parameters to transmit subsequent data units in accordance with an excessive delay response procedure, in response to a determination that the correctly received data unit was the initial data unit.

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36. (Previously Presented) The device of claim 35, wherein the data loss detection mechanism includes:

a first timer in the sender for monitoring a time out period after the at least one data unit is sent, and;

a time out mechanism that that indicates the failure of the receiver to receive the at least one data unit, said time out mechanism being triggered if no acknowledgment data unit associated with the data unit is received before the time out period expires.

37. (Previously Presented) The device of claim 35, wherein the data loss detection mechanism includes a duplicate acknowledgment detection mechanism in the sender that detects whether a predetermined number of duplicate acknowledgment data units are received for a transmitted data unit.

38. (Previously Presented) The device of claim 36, wherein the time out period is one of the adaptive parameters in the flow control procedure.

39. (Currently Amended) The device of claim 35, wherein the ~~retransmission~~ flow-control adapting means ~~includes~~ adapts the size of a ~~window-based~~ flow control window ~~procedure, and at least one flow control window is among the adaptive parameters in the flow control procedure~~.

40. (Currently Amended) The device of claim 35, wherein the determining means includes:

marking means in the sender for marking the transmitted data units such that an ~~original transmission~~ initial data unit can be distinguished from a ~~retransmission~~ retransmitted data unit; and

marking means in the receiver for marking the acknowledgment data units such that an acknowledgment data unit associated with an ~~originally sent~~ initial data unit can be distinguished from an acknowledgment data unit associated with a retransmitted data unit.

41. (Previously Presented) The device of claim 40, wherein:

the marking means in the sender includes a first time stamp mechanism that places a time stamp in each transmitted data unit, the time stamp indicating the time the data unit was sent; and

the marking means in the receiver includes a second time stamp mechanism that places the time stamp contained in a given transmitted data unit in the acknowledgment data unit associated with the given transmitted data unit.

42. (Previously Presented) The device of claim 40, wherein:

the marking means in the sender places a bit string in each transmitted data unit, the bit string having at least two different values for distinguishing between an original transmission and a retransmission; and

the marking means in the receiver places the bit string contained in a particular transmitted data unit in the acknowledgment data unit associated with the particular transmitted data unit.

43. (Previously Presented) The device of claim 42, wherein the bit string consists of a single bit.

44. (Previously Presented) The device of claim 42, wherein the bit string consists of a plurality of bits, such that the bit string is capable of distinguishing between different retransmissions.

45. (Previously Presented) The device of claim 35, wherein the determining means includes:

a first timer in the sender that measures a shortest round trip time associated with the correct receipt of a transmitted data unit;

a second timer in the sender that measures a time period between the retransmission of a given data unit and the receipt of a first acknowledgment data unit associated with the given data unit;

means for comparing the shortest round trip time to the time period between the retransmission of the given data unit and the receipt of the first acknowledgment data unit; and

means for determining that the at least one data unit was correctly received as a result of the transmitting step if the time period between the retransmission of the given data unit and the receipt of the first acknowledgment data unit is shorter than a predetermined fraction of the shortest round trip.

46. (Previously Presented) The device of claim 36, wherein the excessive delay response mechanism includes means for adapting the time out period on the basis of a time period measured between transmitting a given data unit and receipt of a first acknowledgment data unit associated with the given data unit.

47. (Currently Amended) The device of claim 36, wherein the ~~subsequent transmission~~ flow-control adapting means includes a windows-based flow control procedure that utilizes a congestion window, and the device further comprises:

storage means for storing the value of the congestion window when the data loss detection mechanism detects the apparent failure of the receiver to receive the ~~at least one~~ initial data unit;

means for subsequently resetting the value of the congestion window to a predetermined value; and

means for setting the value of the congestion window, after the excessive delay response mechanism performs the excessive delay response procedure, to a value that

the congestion window would have assumed, had the excessive delay response procedure not taken place.

48-49. (Canceled)

50. (New) A method of controlling a data unit oriented communication between a sender and a receiver operating in accordance with a predetermined communication protocol, said method comprising the steps of:

dividing, by the sender, an amount of data to be sent into a plurality of data units having a structure determined by the protocol;

transmitting initial data units from the sender to the receiver;

acknowledging, by the receiver, correct receipt of the initial data units by returning acknowledgment data units to the sender;

detecting an apparent failure of the receiver to receive an initial data unit;

in response to detecting the apparent failure, adapting by the sender, flow control parameters to transmit subsequent data units in accordance with a data unit loss response procedure;

retransmitting, by the sender, the data unit that the receiver apparently failed to receive;

subsequently receiving at the sender, an acknowledgment data unit indicating that the data unit that the receiver apparently failed to receive was correctly received by the receiver;

determining from the received acknowledgment data unit, whether the correctly received data unit was the initial data unit or the retransmitted data unit;

upon determining that the correctly received data unit was the retransmitted data unit, continuing to transmit subsequent data units in accordance with the data unit loss response procedure; and

upon determining that the correctly received data unit was the initial data unit, adapting by the sender, the flow control parameters to transmit subsequent data units in accordance with an excessive delay response procedure.

51. (New) The method of claim 50, wherein the predetermined communication protocol is the Transmission Control Protocol (TCP), and the step of adapting the flow control parameters to transmit subsequent data units in accordance with a data unit loss response procedure includes reducing the size of at least one flow control window.

52. (New) The method of claim 51, wherein the step of adapting the flow control parameters to transmit subsequent data units in accordance with an excessive delay response procedure includes increasing the size of the at least one flow control window to at least partially compensate for reducing the window size in the data unit loss response procedure.

53. (New) The method of claim 50, wherein the step of detecting an apparent failure of the receiver to receive an initial data unit includes the steps of:

monitoring a time out period by the sender after the initial data unit is sent, and;

if no acknowledgment data unit associated with the initial data unit is received before the time out period expires, triggering a time out mechanism that indicates the apparent failure.

54. (New) The method of claim 50, wherein the step of detecting an apparent failure of the receiver to receive an initial data unit includes the steps of:

determining by the sender whether duplicate acknowledgment data units are received for a transmitted data unit; and

if a data unit is acknowledged a predetermined number of times, triggering a duplicate acknowledgment detection mechanism that indicates the apparent failure.

55. (New) The method of claim 50, wherein each of the initial data units includes a sequential time stamp, and each of the acknowledgment data units includes the time stamp of the initial data unit that is being acknowledged, wherein the step of determining from the received acknowledgment data unit whether the correctly received data unit was the initial data unit or the retransmitted data unit includes inspecting the time stamp included in the received acknowledgment data unit.

56. (New) A method of controlling a data unit oriented communication between a sender and a receiver operating in accordance with a predetermined communication protocol, said method comprising the steps of:

dividing, by the sender, an amount of data to be sent into a plurality of data units having a structure determined by the protocol;

transmitting initial data units from the sender to the receiver;

acknowledging, by the receiver, correct receipt of the initial data units by returning acknowledgment data units to the sender;

detecting a failure of the receiver to receive at least one data unit by monitoring a time out period by the sender after the at least one data unit is sent, and if no acknowledgment data unit associated with the data unit is received before the time out period expires, triggering a time out mechanism that indicates the failure;

retransmitting, by the sender, the at least one data unit that the receiver failed to receive, wherein each retransmitted data unit includes a marker indicating that the retransmitted data unit is a retransmitted data unit;

receiving at the sender, an acknowledgment data unit indicating that one of the data units was correctly received by the receiver, wherein the acknowledgment data unit includes the marker if the data unit correctly received by the receiver was a retransmitted data unit;

determining from the received acknowledgment data unit, whether the correctly received data unit was an initial data unit or a retransmitted data unit by determining whether the marker is present in the acknowledgment data unit; and

subsequently transmitting, by the sender, subsequent data units, said subsequent data units being transmitted in accordance with a flow control procedure conducted on the basis of at least one adaptive parameter, said subsequently transmitting step including:

performing an excessive delay response procedure upon determining that the received acknowledgment data unit indicates that the correctly received data unit was an initial data unit; and

performing a data unit loss response procedure upon determining that the received acknowledgment data unit indicates that the correctly received data unit was a retransmitted data unit.

57. (New) A method of controlling a data unit oriented communication between a sender and a receiver operating in accordance with a predetermined communication protocol, said method comprising the steps of:

dividing, by the sender, an amount of data to be sent into a plurality of data units having a structure determined by the protocol;

transmitting initial data units from the sender to the receiver, wherein each initial data unit includes a first marker indicating that the initial data unit is an initial data unit;

acknowledging, by the receiver, correct receipt of the initial data units by returning acknowledgment data units to the sender, wherein the acknowledgment data units include the first marker if the data unit received by the sender was an initial data unit;

detecting a failure of the receiver to receive at least one data unit by monitoring a time out period by the sender after the at least one data unit is sent, and if no acknowledgment data unit associated with the data unit is received before the time out period expires, triggering a time out mechanism that indicates the failure;

retransmitting, by the sender, the at least one data unit that the receiver failed to receive, wherein each retransmitted data unit includes a second marker indicating that the retransmitted data unit is a retransmitted data unit;

receiving at the sender, an acknowledgment data unit indicating that one of the data units was correctly received by the receiver, wherein the acknowledgment data unit includes the first marker if the data unit correctly received by the receiver was an initial data unit, and includes the second marker if the data unit correctly received by the receiver was a retransmitted data unit;

determining from the received acknowledgment data unit, whether the correctly received data unit was an initial data unit or a retransmitted data unit by determining whether the acknowledgment data unit includes the first or the second marker, respectively; and

subsequently transmitting, by the sender, subsequent data units, said subsequent data units being transmitted in accordance with a flow control procedure conducted on the basis of at least one adaptive parameter, said subsequently transmitting step including:

performing an excessive delay response procedure upon determining that the received acknowledgment data unit indicates that the correctly received data unit was an initial data unit; and

performing a data unit loss response procedure upon determining that the received acknowledgment data unit indicates that the correctly received data unit was a retransmitted data unit.

58. (New) The method of claim 57, wherein the first and second markers include a single bit.

59. (New) The method of claim 57, wherein the first and second markers are time stamps indicating a time of transmission of the initial data unit and the retransmitted data unit, respectively.

60. (New) A method of controlling a data unit oriented communication between protocol peers operating in accordance with a predetermined communication protocol, said method comprising the steps of:

dividing, by a first protocol peer, an amount of data to be sent into a plurality of data units having a structure determined by the protocol;

transmitting initial data units from the first protocol peer to a second protocol peer;

acknowledging, by the second protocol peer, correct receipt of the initial data units by returning acknowledgment data units to the first protocol peer;

detecting an apparent failure of the second protocol peer to receive an initial data unit;

in response to detecting the apparent failure, adapting flow control parameters to transmit subsequent data units in accordance with a data unit loss response procedure;

retransmitting, by the first protocol peer, the data unit that the second protocol peer apparently failed to receive;

subsequently receiving at the first protocol peer, one or more acknowledgment data units indicating that the data unit that the second protocol peer apparently failed to receive was correctly received by the second protocol peer;

determining from the one or more received acknowledgment data units, whether the correctly received data unit was the initial data unit or the retransmitted data unit;

upon determining that the correctly received data unit was the retransmitted data unit, continuing to transmit subsequent data units in accordance with the data unit loss response procedure; and

upon determining that the correctly received data unit was the initial data unit, adapting the flow control parameters to transmit subsequent data units in accordance with an excessive delay response procedure.